INTERNATIONAL PRELIMNARY EXAMINING AUTHORITY - USPTO

| | | |
|---|---|---|
| In re Application of | ) | RICHAUD, et al. 10/576999 |
| Title | ) | Rippled Surface Stopper Rod System |
| Int'l Application Number | ) | PCT/US2004/036718 |
| Int'l Publication No. | ) | WO2004/042189 A2 |
| Int'l Filing Date | ) | 3 November, 2004 |
| Attorney Docket No. | ) | 1461 WO |

To: Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

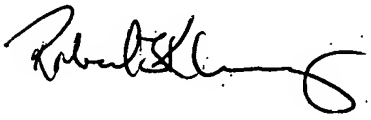
AMENDMENTS AND STATEMENT UNDER ARTICLE 19

Please find attached herewith Replacement Sheets for pages 7 & 8 of the above-identified application. Claims 1-15 are replaced by amended claims 1-15. The claims have been amended to conform to the two-part form and reference numerals as required by Rule 6.3(b) PCT. Claims 2, 9 and 13 have also been amended to change the terminology "does not decrease" to "remains the same or increases."

Date: November 9, 2005

Respectfully submitted,

Vesuvius USA Corporation
27 Nobletown Road
Carnegie, PA 15106-1632
Tel: 412-429-1800 x6921
Fax: 412-276-7252



Robert S. Klemz
Attorney for Applicants

**Claims.**

We claim:

1. A stopper rod system for use in a metallurgical vessel, comprising a stopper rod having a nose on one end thereof, and a nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the nozzle bore having a point of contact when the stopper rod system is in a closed position; **characterized in that** at least one of the stopper rod nose (42) and the internal surface of the nozzle bore (43) comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact (44).

2. A stopper rod system according to claim 1, **characterized in that** the size of the flow channel remains the same or increases downstream from the point of contact(44).

3. A stopper rod system according to claim 1, **characterized in that** the increase in size of the flow channel due to the ripple nearest the point of contact (44) is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact (44).

4. A stopper rod system according to claim 1, **characterized in that** the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact (44).

5. A stopper rod system according to claim 1, **characterized in that** the stopper rod nose (42) comprises the plurality of ripples.

6. A stopper rod system according to claim 1, **characterized in that** the internal surface of the nozzle bore (43) comprises the plurality of ripples.

7. A stopper rod system according to claim 1, **characterized in that** both of the stopper rod nose (42 )and the internal surface of the nozzle bore (43) comprise a plurality of ripples.

8. A stopper rod for use in a stopper rod system, the stopper rod system comprising the stopper rod having a nose on one end thereof, and a nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the bore having a point of contact when the stopper rod system is in a closed position; **characterized in that** the stopper rod nose (42) comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact (44).

9. A stopper rod according to claim 8, **characterized in that** the size of the flow channel remains the same or increases downstream from the point of contact (44).

10. A stopper rod according to claim 8, **characterized in that** the increase in size of the flow

channel due to the ripple nearest the point of contact is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact (44).

11. A stopper rod according to claim 8, **characterized in that** the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact (44).

12. A nozzle for use in a stopper rod system, the stopper rod system comprising a stopper rod having a nose on one end thereof, and the nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the bore having a point of contact when the stopper rod system is in a closed position; **characterized in that** the internal surface of the nozzle bore (43) comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact (44).

13. A nozzle according to claim 8, **characterized in that** the size of the flow remains the same or increases downstream from the point of contact (44).

14. A nozzle according to claim 8, **characterized in that** the increase in size of the flow channel due to the ripple nearest the point of contact is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact (44).

15. A nozzle according to claim 8, **characterized in that** the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact (44).

AMENDED CLAIMS
[received by the International Bureau on 9th November 2005 (09.11.05)]

1. A stopper rod system for use in a metallurgical vessel, comprising a stopper rod having a nose on one end thereof, and a nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the nozzle bore having a point of contact when the stopper rod system is in a closed position; **characterized in that** at least one of the stopper rod nose (42) and the internal surface of the nozzle bore (43) comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact (44).

2. A stopper rod system according to claim 1, **characterized in that** the size of the flow channel remains the same or increases downstream from the point of contact(44).

3. A stopper rod system according to claim 1, **characterized in that** the increase in size of the flow channel due to the ripple nearest the point of contact (44) is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact (44).

4. A stopper rod system according to claim 1, **characterized in that** the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact (44).

5. A stopper rod system according to claim 1, **characterized in that** the stopper rod nose (42) comprises the plurality of ripples.

6. A stopper rod system according to claim 1, **characterized in that** the internal surface of the nozzle bore (43) comprises the plurality of ripples.

7. A stopper rod system according to claim 1, **characterized in that** both of the stopper rod nose (42 )and the internal surface of the nozzle bore (43) comprise a plurality of ripples.

8. A stopper rod for use in a stopper rod system, the stopper rod system comprising the stopper rod having a nose on one end thereof, and a nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the bore having a point of contact when the stopper rod system is in a closed position; **characterized in that** the stopper rod nose (42) comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact (44).

9. A stopper rod according to claim 8, **characterized in that** the size of the flow channel remains the same or increases downstream from the point of contact (44).

10. A stopper rod according to claim 8, **characterized in that** the increase in size of the flow

channel due to the ripple nearest the point of contact is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact (44).

11. A stopper rod according to claim 8, **characterized in that** the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact (44).

12. A nozzle for use in a stopper rod system, the stopper rod system comprising a stopper rod having a nose on one end thereof, and the nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the bore having a point of contact when the stopper rod system is in a closed position; **characterized in that** the internal surface of the nozzle bore (43) comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact (44).

13. A nozzle according to claim 8, **characterized in that** the size of the flow remains the same or increases downstream from the point of contact (44).

14. A nozzle according to claim 8, **characterized in that** the increase in size of the flow channel due to the ripple nearest the point of contact is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact (44).

15. A nozzle according to claim 8, **characterized in that** the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact (44).